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Supporting Information

Post-annealing to Recover the Reduced Open-circuit Voltage Caused by Solvent Annealing in Organic Solar Cells

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Author contributions. Yuanpeng Xie and Weihua Zhou contributed equally to this work.

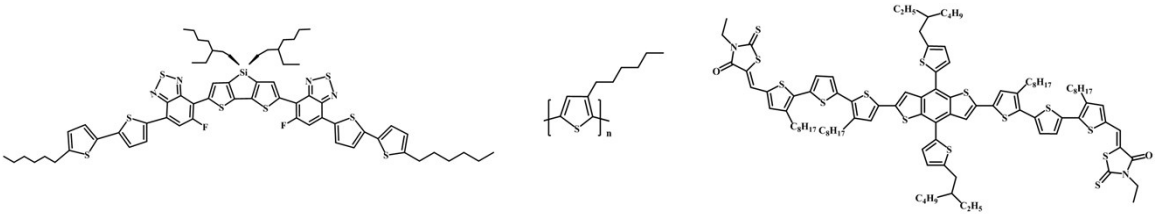

Figure S1 Molecular structure of *p*-DTS(FBTTh$_2$)$_2$, P3HT and DR3TBDTT, respectively.

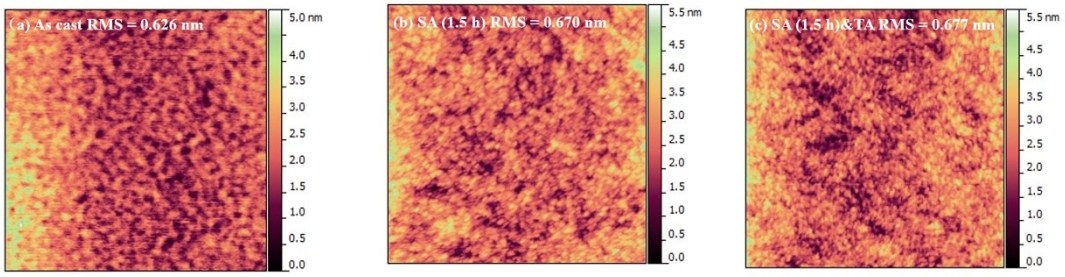

Figure S2 Atomic force microscope (AFM) topography images of the films (a) at cast RMS = 0.626 nm, (b) SA (1.5 h) RMS = 0.670 nm, (c) SA(1.5 h) & TA RMS = 0.677 nm.

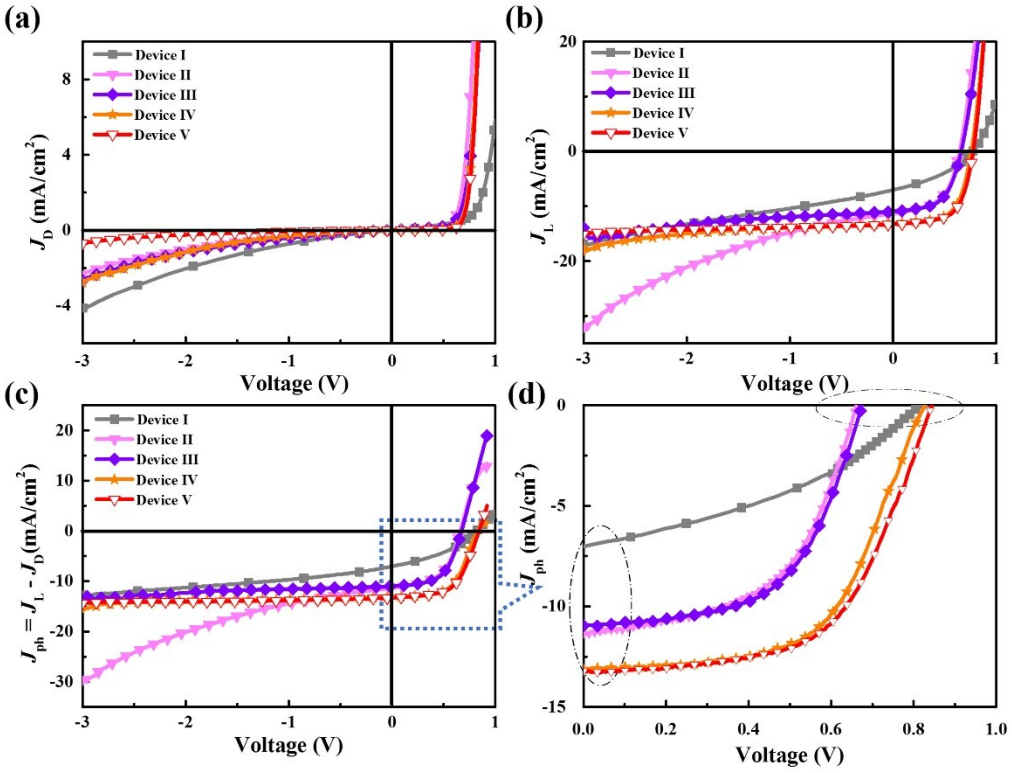

Figure S3 The detail curve of J_L, J_D and $J_{ph.}$ (a) J_D-V curve in dark with the bias voltage from -3 V to +1 V, (b) J_L-V curve under 100 mW/cm^2 simulated irradiation with bias voltage from -3 V to +1 V, (c) J_{ph}-V curve obtained by J_L-J_D with bias voltage from -3 V to +1 V, (d) the detail data of J_{ph}-V curve with the bias voltage from 0 V to +1 V.

Table S1 Photovoltaic parameters of *p*-DTS(FBTTh$_2$)$_2$:PC$_{71}$BM solar cells fabricated under different conditions. The data were obtained from over 5 devices for each.

Process conditions	V_{oc} (mV)	J_{sc} (mA/cm^2)	FF (%)	PCE (%)
Device I	809 ± 10	6.47 ± 0.23	38.5 ± 1.2	2.0 ± 0.1
Device II	563 ± 25	11.40 ± 1.0	48.7 ± 5.1	3.1 ± 0.4
Device III	690 ± 20	10.89 ± 0.5	58.1 ± 5.6	4.3± 0.4
Device IV	762 ± 14	11.63 ± 0.52	66.6 ± 4.0	6.1 ± 0.3
Device V	788 ± 8	12.53 ± 0.60	66.5 ± 5.1	6.6 ± 0.4

Table S2 Photovoltaic parameters of P3HT:$PC_{61}BM$ and DR3TBDTT:$PC_{71}BM$ solar cells fabricated under different conditions. The data were obtained from three devices for each.

Systems	Conditions	V_{oc} (mV)	J_{sc} (mA/cm^2)	FF (%)	PCE (%)
P3HT:$PC_{61}BM$	**As cast**	620 ± 8	7.50 ± 0.3	48 ± 3	2.2 ± 0.3
	SA	587 ± 10	8.96 ± 0.6	68.3 ± 2	3.7 ± 0.2
	SA&TA	610 ± 5	7.57 ± 0.5	66.0 ± 3	3.1 ± 0.1
	SA&PA	616 ± 3	7.77 ± 0.4	69.8 ± 2	3.3 ± 0.2
DR3TBDTT:$PC_{71}BM$	**As cast**	850 ± 4	9.56 ± 0.3	57.6 ± 7	4.8 ± 0.4
	SA	809 ± 10	10.45 ± 0.4	56.0 ± 5	4.7 ± 0.2
	SA&TA	810 ± 9	11.47 ± 0.2	59.0 ± 2	5.5 ± 0.2
	SA&PA	848 ± 5	12.07 ± 0.2	63.2 ± 3	6.5 ± 0.3

[#]SA&TA Solvent annealing with further thermal annealing on active layer
[*]SA&PA Solvent annealing on active layer with further post-annealing on whole device

Detailed Fabrication Process for Devices Based on P3HT and DR3TBDTT

Active layers of P3HT:$PC_{61}BM$ at weight ratio of 1:1 with an overall concentration of 40 mg/mL were spun at 800 rpm for 30 s and 1400 rpm for 2 s. Solution in dichlorobenzene was heated for one night at 50 °C prior to cast. Then, the active layer was solvent (dichlorobenzene) annealed for 1.5 h. The specimens treating by solvent annealing were further annealed at 65 °C for 10 min deposited by active layer, MoO_3/Ag. Similarly, active layers of DR3TBDTT:$PC_{71}BM$ at weight ratio of 1.8:1 with an overall concentration of 20 mg/mL were spun at 1700 rpm for 30 s. Solution in chloroform was stirred for one night at room temperature prior to cast. Then, the active layer was solvent (chloroform) annealed for 1.5 h. The specimens treating by solvent annealing were further annealed at 100 °C for 10 min deposited by active layer, MoO_3/Ag.